

FY 1977 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 35158F
Category: Operational Systems

Title: Satellite Data System
Budget Activity: #4 Military Astronautics and Related Equipment

RESOURCES / PROJECT LISTING /: (\$ in Thousands)

| Project Number | Title | FY 1975 Actual | FY 1976 Estimate | FY 1977 Estimate | FY 1978 Estimate | Additional to Completion | Total Estimated Cost |
|-------------------|---------------------------|-------------------|---------------------|---------------------|---------------------|-----------------------------|-------------------------|
| | TOTAL FOR PROGRAM ELEMENT | 38,097 | 30,079 | 3,962 | 15,400 | 14,300 | Continuing |
| | Not applicable | | | | | | Not applicable |

BRIEF DESCRIPTION OF ELEMENT: The Satellite Data System (SDS) is a multipurpose, polar coverage communications satellite which will provide reliable and secure communications over the north polar regions. Operating in conjunction with the synchronous equatorial orbiting Fleet Satellite Communications (FLTSATCOM) satellites, the SDS completes the global coverage required by the Air Force Satellite Communications (AFSATCOM) system for essential command and control communications for strategic forces.

BASIS FOR FY 1977 RDT&E REQUEST: This request includes funds to complete the initial engineering design and development of the satellite system. Funds are also included to conduct the development engineering necessary to transition follow-on spacecraft to the Space Shuttle and to improve the anti-jam capabilities and performance of the Ultra High Frequency (UHF) payload which supports the AFSATCOM mission.

BASIS FOR INCREASE IN 1977 OVER 1976: Not applicable

PERSONNEL IMPACT: RDT&E Procurement Total

The average number of employees supporting this program element is as follows:

| | | | |
|------------------------|-----|-----|-----|
| Federal Civ. Employees | 6 | 15 | 21 |
| Contractor Employees | 214 | 482 | 696 |
| Total | 220 | 497 | 717 |

TERMINATION COST:

Estimated government liability financed with:

| <u>FY 1976/TQ & Prior Funds</u> | <u>FY 1977</u> | <u>Total</u> |
|---|----------------|--------------|
|---|----------------|--------------|

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DETAILED BACKGROUND AND DESCRIPTION: The Satellite Data System (SDS) is designed to provide critical transpolar, two-way, real-time command, control and communications for Strategic Air Command Single Integrated Operational Plan (SIOP) forces. Since a synchronous equatorial orbit cannot provide communications coverage over the polar regions above 70 degrees North Latitude, a highly inclined elliptical orbit was selected for the SDS to provide

SDS is an integral part of the Air Force Satellite Communications (AFSATCOM) system which includes the Air Force Ultra High Frequency (UHF) communications capability on the synchronous equatorial Fleet Satellite Communications (FLTSATCOM) program, piggy-back transponders on selected host satellites, and airborne/ground radio terminals. As such, the SDS will complement the FLTSATCOM program by providing the requisite polar UHF capability. Additionally, the SDS will support the Air Force Satellite Control Facility (AFSCF) requirement for reliable two-way high data rate, S-band communications between the AFSCF remote tracking station at Thule, Greenland and the CONUS.

The direct benefits derived from the SDS capabilities will be the reliable and secure direct communications linkage over the polar regions to provide greatly improved command and control of SIOP forces, eliminate the dependence on vulnerable undersea cables to the Thule station.

RELATED ACTIVITIES: The space segment of the FLTSATCOM will be developed, procured and launched under FLTSATCOM Program Element, PE 33109N. The Air Force aircraft and ground UHF radio terminals required for operation with the FLTSATCOM and SDS satellites will be procured within the AFSATCOM Program Element, PE 33601F. The AFSCF stations are funded under the AFSCF Program Element, 35110F.

WORK PERFORMED BY: Headquarters, Air Force Systems Command, Space and Missile Systems Organization (SAMSO), Los Angeles, California, is responsible for the SDS. The primary contractor is Hughes Aircraft Company, El Segundo, California. General Systems Engineering and Technical Direction (GSE/TD) is performed by The Aerospace Corporation, El Segundo, California.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1975 and Prior Accomplishments:

The technology phase of the program was completed in FY 1971. This was followed by a contract definition phase in FY 1972 which established the system configuration. The system acquisition contractor was selected by competitive source selection and a system development contract was awarded in June 1972. The system Critical Design Review (CDR) was successfully completed in March of 1974 with all critical specifications being met or exceeded. The structural and qualification model spacecraft and the initial flight vehicle (F-1) are being procured incrementally with Research, Development, Test and Evaluation (RDT&E) funds. A production option to the development contract was exercised beginning in FY 1974. This option provides for the fabrication, assembly, and test of the first production model spacecraft (F-2) and a backup flight vehicle (F-3). The development and production schedules are phased to achieve the required delivery, launch and system operational dates.

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Communications subsystem engineering models were fabricated and tested by November 1973. The structural model spacecraft testing was completed in May 1975. A qualification model spacecraft was built and tested to fully qualify all systems at greater than expected orbital levels. the qualification model spacecraft will be refurbished for use as a replenishment flight vehicle (F-4).

2. FY 1976 Program: During FY 1976, system level qualification was completed (October 1975)

Launch vehicle integration and software development will be completed during this fiscal year. Study and preliminary design to transition follow-on spacecraft to launch aboard the Space Shuttle will be initiated.

3. FY 1977 Program:

The backup flight vehicle (F-3) will be delivered

4. FY 1977 Planned Program: Activities planned during this period include sustaining engineering support, initiation of study and preliminary design to improve follow-on satellites for survivability, reliability, and performance. Design work to convert follow-on satellites to launch on the Space Shuttle will also be continued.

5. FY 1978 Planned Program: The FY 1978 program will continue sustaining engineering support and fund the design and development activities to improve follow-on satellites and transition to the Space Shuttle. Procurement of the fifth flight vehicle (F-5) will be initiated in FY 1978.

6. Program to Completion: This is a continuing program. As an integral part of the Air Force Satellite Communications (AFSATCOM) system, the program will continue to provide critical communications coverage and be totally compatible with the AFSATCOM aircraft and ground radio terminals. Sustaining engineering support will be required to maintain design compatibility; to incorporate improvements for survivability, reliability and capability and to provide additional replenishment spacecraft.

7. Milestones:

| | <u>Date</u> | <u>Estimated Cumulative RDT&E Cost to Reach Milestones (\$ in Thousands)</u> |
|---|-------------|--|
| A. System Preliminary Design Review | Mar 73 | 49,600 |
| B. System Critical Design Review | Mar 74 | 96,600 |
| C. First Article Configuration Inspection | | |
| D. Launch First Spacecraft | | |
| E. Launch Second Spacecraft | | |
| F. Full Operational Capability | | |

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8. RESOURCES: (\$ in Thousands)

| | <u>FY 1975</u> | <u>FY 1976</u> | <u>FY 1977</u> | <u>FY 1978</u> | <u>Additional to Completion</u> | <u>Total Estimated Cost</u> | |
|---|----------------|----------------|----------------|----------------|---|-------------------------------------|----------------|
| RDT&E: Funds | 38,097 | 30,079 | 13,962 | 15,400 | 14,300 | Continuing | Not applicable |
| *Quantities | | | | | | | |
| Flight Model Spacecraft | | | | | | | 1 |
| T-IIIIB/Agna Launch Vehicles | | | | | | | 1 |
| *These quantities are procured over the period of initial contract. | | | | | | | |
| Missile Procurement: | | | | | | | |
| Funds (3020) | 42,900 | 9,600 | 13,400 | 59,400 | 54,700 | Continuing | Not applicable |
| Quantities | | | | | | | |
| Flight Model Spacecraft | | | | | | | 4** |
| T-IIIIB/Agna Launch Vehicles | | | | | | | 4** |

**The Qualification Spacecraft will be refurbished and used as replenishment flight vehicle.

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Program Element: 35158F - Satellite Data System

Test and Evaluation Data

1. Development Test and Evaluation: The development contractor for the Satellite Data System (SDS) is Hughes Aircraft Company, El Segundo, California. The contractor is conducting the development program in support of satellite launches]to establish the initial orbital deployment and achieve an Initial Operational Capability. The first satellite to be launched (F-1) is being funded entirely within the development program. The second flight spacecraft (F-2) is the first vehicle being funded under the production program. The development hardware includes engineering models of the communication subsystems, a structural model spacecraft (X-1) and a full-up qualification model spacecraft (Y-1). Development tests of the communications subsystems engineering models were completed in November 1973. Structural testing was satisfactorily completed on the X-1 model spacecraft in May 1975. Systems level qualification was completed in October 1975 with all critical performance specifications being met or exceeded. System level qualification is designed to demonstrate design integrity and performance to specification via a series of tests including shock, acoustic, model survey, thermal, electromagnetic interference (EMI), solar-thermal vacuum, and integrated system test. Reliability (life) tests of critical components will continue throughout the development program. The F-1 spacecraft will undergo acceptance test during the The Y-1 spacecraft is a full configured spacecraft which will be refurbished, as required, and used as a back-up flight vehicle (F-4).

2. Operational Test and Evaluation: OT&E is accomplished on the individual systems supported by this program element, such as: AFSATCOM, PE 33601F and Satellite Control Facility, PE 35110F.

3. Systems Characteristics:

a. UHF mission characteristics

~~240-400 MHz~~
~~12 - 5 KHz channels, 75 BPS, two-way teletype~~
Anti-Jam capability -

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b. AFSCF Mission Characteristics

~~1.76 - 2.3 GHz (S-Band)~~
Data pass ~~256 KBs, 32 KBs~~

c. ~~64° elliptical~~ orbit, ~~12 hr~~ period, transpolar coverage.

d. Orbital life Mean Mission Duration (MMD) - -

Mission characteristics will be validated during DT&E. Operational characteristics and orbit performance will be demonstrated during OT&E.